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Methods of Estimating Recharge in the Desert Southwest

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U.S. Geological Survey

Southwest Ground-Water Resources Study

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Study Components

- Regional synthesis
- GW development and riparian ecosystems
- Climate variations and GW systems
- Improved methods of quantifying recharge
- Improved methods of simulating stream-aquifer interaction

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Strategy for Recharge Site Studies

- Multiple sites across the Southwest
- Suite of methods applied at each site
- Collect and analyze data for 4 – 5 years
- Synthesize the results

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Recharge Study Sites

Four study sites have been set up across the Southwest

- Mojave Desert
- Great Basin
- Sonoran Desert
- Rio Grande

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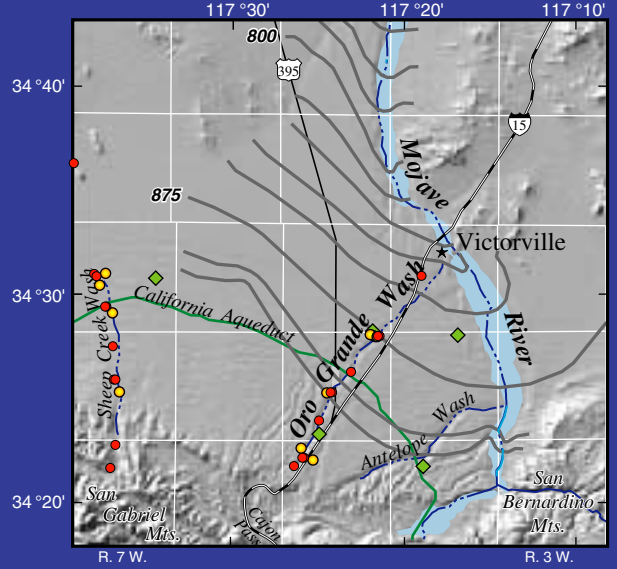
Mojave Desert – Oro Grande Wash



- Regional aquifer
- Alluvial aquifer
- 1930 water-level contour
- Borehole
- Precipitation chemistry collector
- Temperature collection site

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Great Basin – Trout Creek

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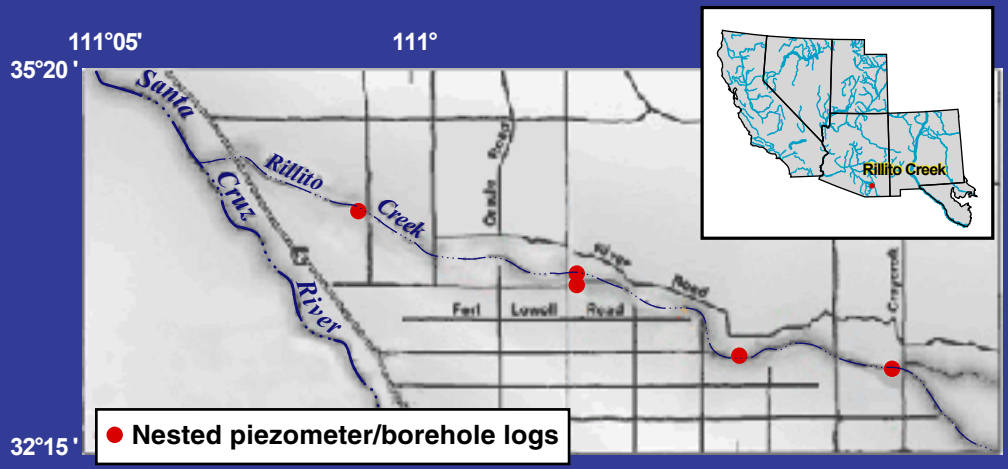
Sonoran Desert – Rillito Creek



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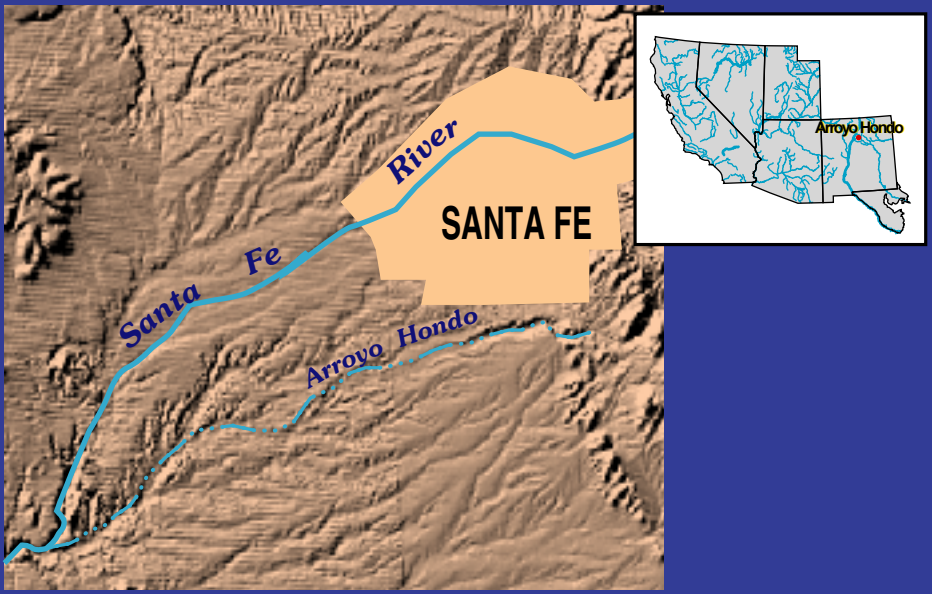
Rio Grande – Arroyo Hondo



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Methods

Similar instrumentation and analyses will be set up for each site

- Chemical analyses
- Use of heat as a tracer
- Darcian flow measurements
- Repeat microgravity and other geophysical measurements
- Measurement of ephemeral streamflows

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Method 1

- Chemical mass balances
  - Chloride
  - Tritium
  - Deuterium/Oxygen-18
  - Others?

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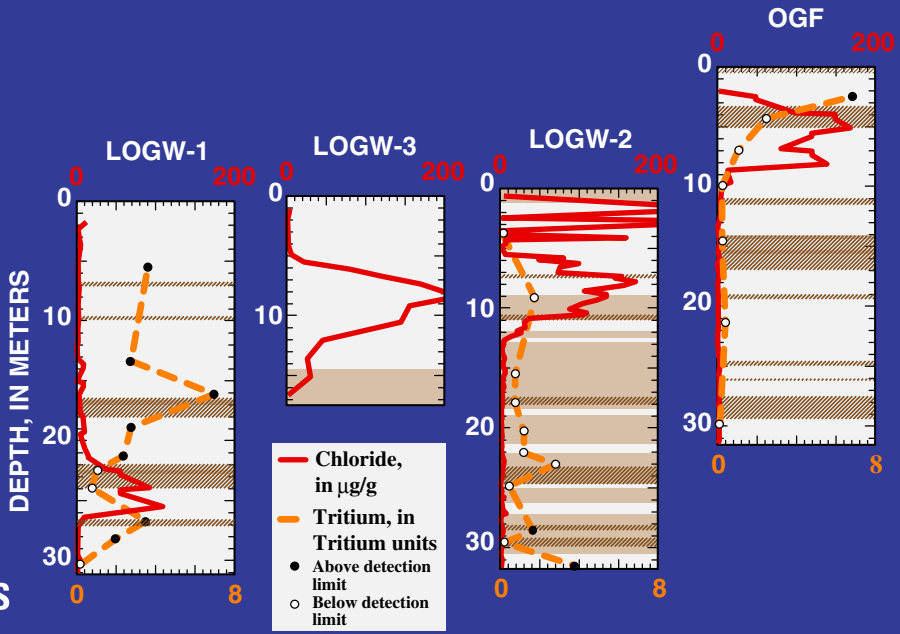
Oro Grande – Chloride and Tritium



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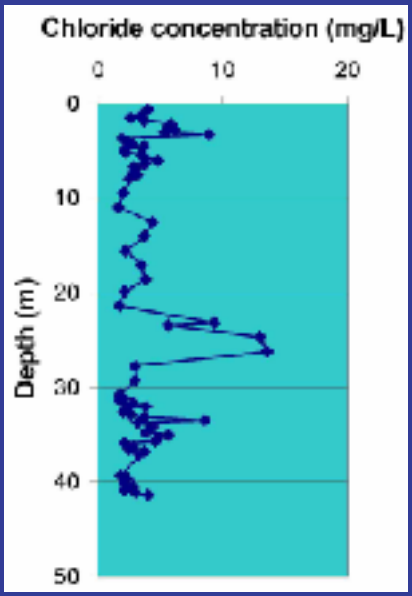
Rillito Creek at LaCholla



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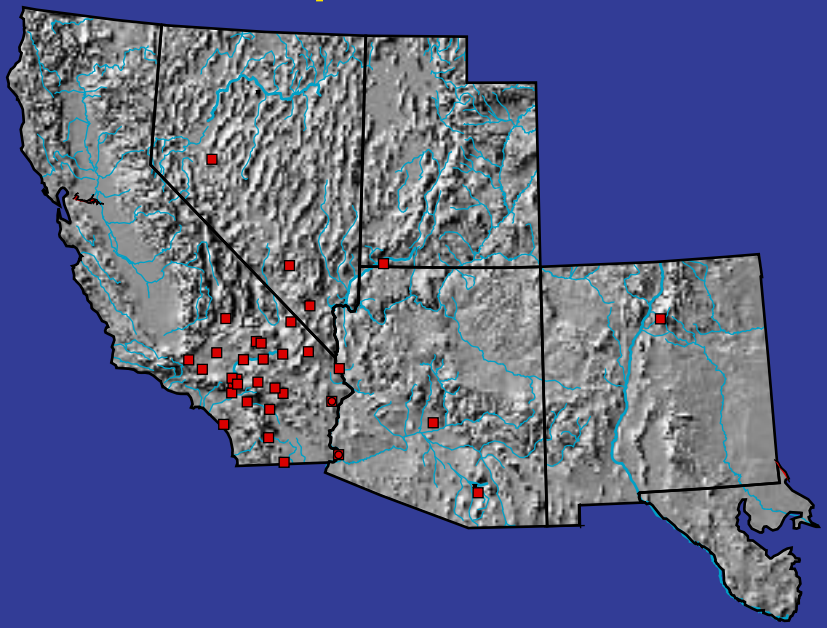
Chloride-Deposition Network



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Method 2

- Use of heat as a tracer
  - Streambed temperature sensors
  - Vertical strings of temp sensors
  - Analysis with VS2DH

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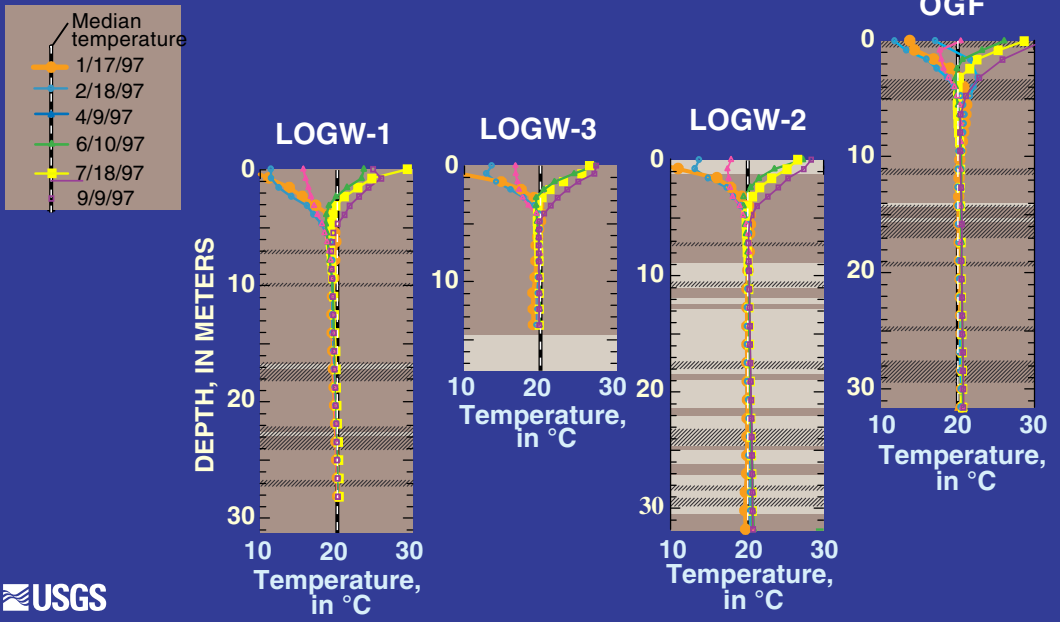
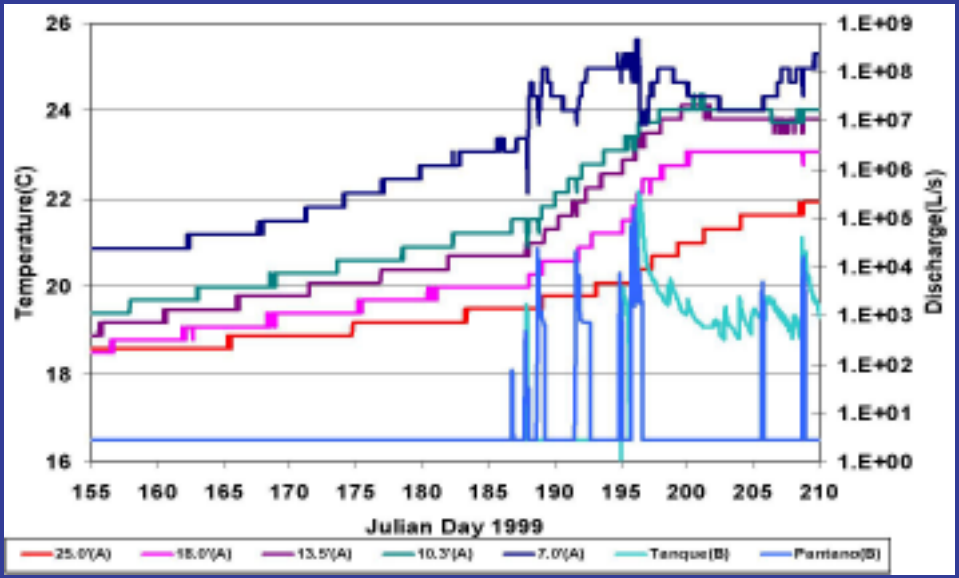
Oro Grande – Temperature



Craycroft Temperature & Discharge Data



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Method 3

- Darcian flow measurements
  - Extract intact cores from subsurface
  - Determine water content
  - Using SSCM, determine $K(\theta)$

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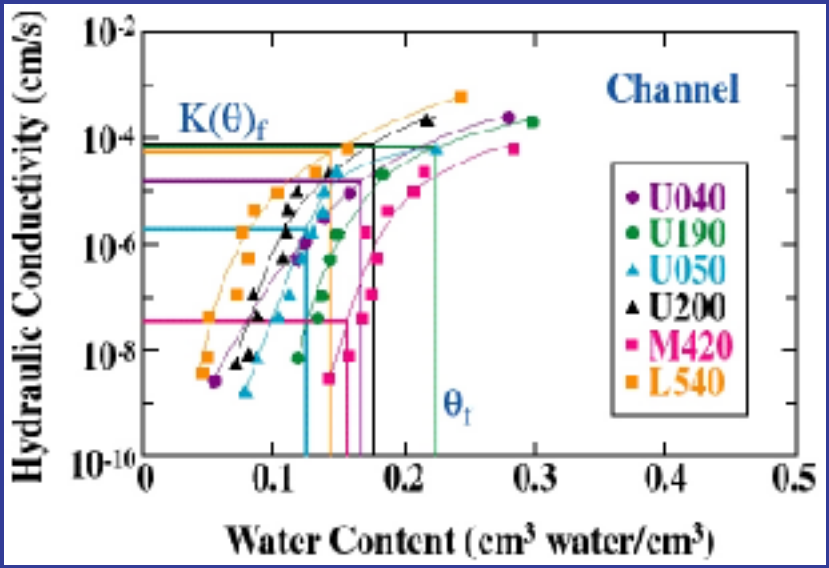
Unsaturated Hydraulic Conductivity Determined from the SSCM



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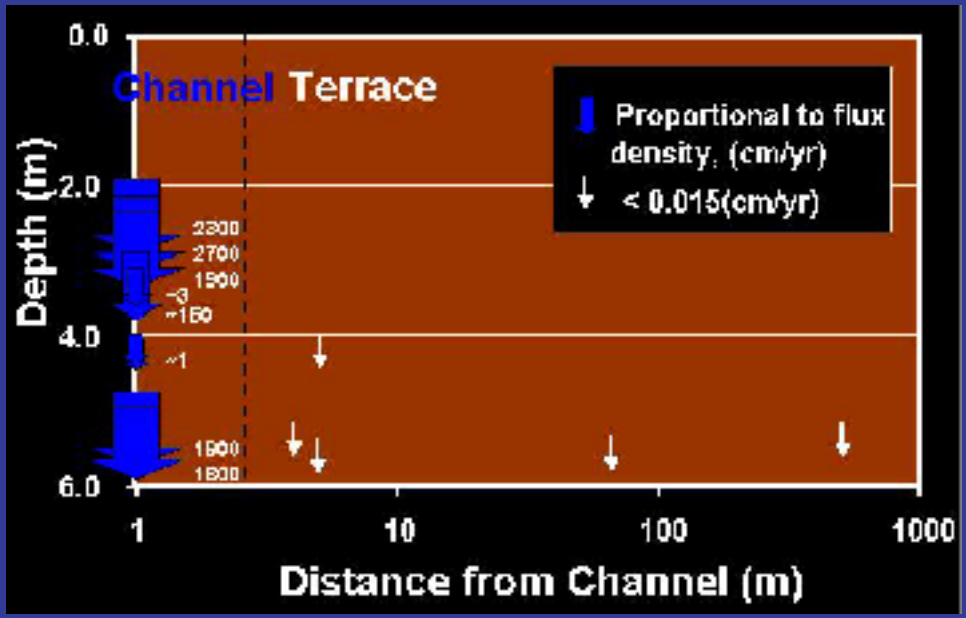
0.0
Channel
Terrace
Proportional to flux density, (cm/yr)
< 0.015(cm/yr)
Depth (m)
2.0
2300
2700
1500
~3
~150
4.0
~1
1900
1800
6.0
1
10
100
1000
Distance from Channel (m)

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Method 4

- Geophysical measurements
  - Repeat microgravity surveys
  - Neutron soil-moisture surveys
  - NMR?
  - Others?

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Method 5

- Channel-loss measurements
  - Stream gages
  - Load sensors

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Recharge Study Sites–Methods

	Oro Grande	Trout Creek	Rillito Creek	Arroyo Hondo
Geochemical analyses	●	●	●	●
Heat tracing	●	●	●	●
Darcian flow	●	●	●	●
Geophysical surveys		●	●	
Channel loss		●	●	●

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Related Recharge Studies

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If you have an interest in conducting research at these recharge study sites or obtaining USGS data from these sites, please contact

Stan Leake, USGS, Tucson
saleake@usgs.gov
(520) 670-6671 ext 259

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